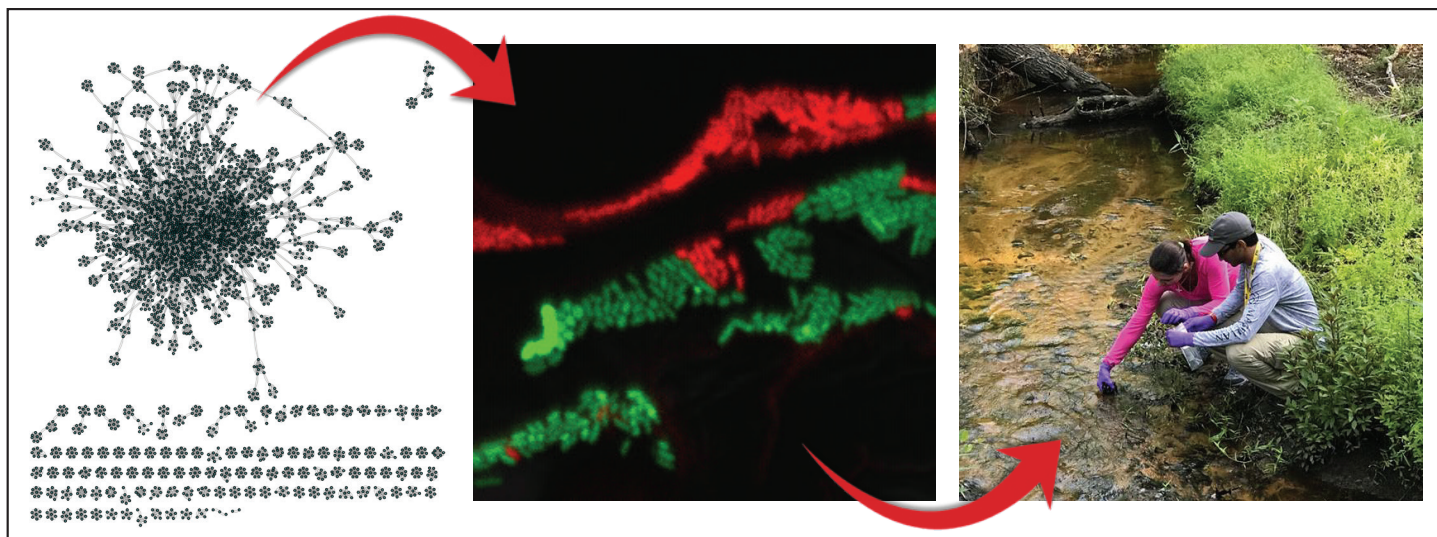


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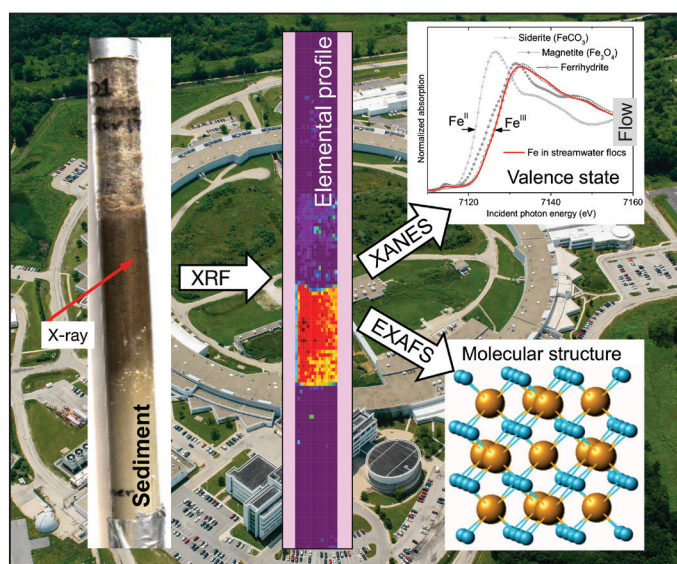
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Integration of Bioinformatic Approaches into Hydro-biogeochemistry. The Argonne SFA develops and uses omics-based approaches to understand microbially driven controls on hydro-biogeochemical processes in the field. The biogeochemical transformations performed by individual organisms, consortia, and communities are determined with sequencing technologies, model development, and bioinformatic approaches.

approaches at Argonne's Advanced Photon Source (APS), omics-based approaches and collaborative research with DOE Systems Biology Knowledgebase (KBase) researchers at Argonne and Lawrence Berkeley national laboratories, and mass spectrometry-based approaches to characterize carbon chemistry through collaboration with scientists at BER's Environmental Molecular Sciences Laboratory—are used to analyze field and laboratory materials.

In addition, SFA experimental work drives optimization of synchrotron-based techniques at APS beamlines with the characteristics required for the project, thereby increasing X-ray beamline productivity while also benefitting the larger international synchrotron-based biogeochemistry research community.



Synchrotron-Based Hydro-biogeochemistry. (Overlay) The spatial heterogeneity of molecular-scale information within sediment cores can be gathered via X-ray measurements made at the Advanced Photon Source. Synchrotron-based approaches are used to develop molecular- to core-scale mechanistic understanding of the role of hydrologically driven and coupled iron and carbon biogeochemical processes on nutrient and contaminant cycling and controls on water quality. Key: XANES, X-ray absorption near-edge structure; EXAFS, extended X-ray absorption fine structure; XRF, X-ray fluorescence.

Merging Experimental and Modeling Approaches

Initial modeling approaches focus on reactive transport models (RTMs) of lab-based, mixed-batch reactors; diffusive and advective flow experiments; and small-scale field observations. RTMs are supplemented with metabolic modeling of microorganisms and interacting consortia to more accurately capture the role of microbial communities in mediating biogeochemical transformations. These models are used for hypothesis testing and to analyze the sensitivity of hydro-biogeochemical processes in determining water quality. A preliminary hydrological model has already been developed for the SRS watershed that contains the wetland study site. It provides key insights and data related to surface and groundwater flow within the watershed and is critical for identifying the hydrological drivers of the biogeochemical processes to be integrated into RTMs. The iterations between lab- and field-based experiments in concert with modeling improve both aspects of the SFA research.

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